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ABSTRACT

This paper provides basic information about telecommunication technologies that can be used to deliver training, education, public awareness activities, and other assistive-technology related services to individuals with disabilities in distant locations. The review of current and viable telecommunication technologies is accompanied by examples of effective partnerships and networking that can be replicated or adapted by service providers and consumers. In some cases, the telecommunication technology is the technology-related assistance itself; in other situations, telecommunications is the vehicle carrying the information and training needed to enhance the delivery of technology-related assistance to individuals with disabilities, their families, and service providers. Technologies discussed include cable television, satellite television, teleconferencing, interactive television, fiber optics, microwave and instructional television fixed service (ITFS), computer-based applications, and combinations of these media. The paper also discusses the planning process for using distance learning technologies, the cost of telecommunication technology, and sources of cooperation. A case study is offered of the Maine Consumer Information and Technology Training Exchange, a project funded under the Technology-Related Assistance for Individuals with Disabilities Act of 1988. The project uses interactive television to provide training and public awareness on assistive technology to persons with disabilities and service providers. A glossary and a list of 11 references conclude the paper. (JDD)

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TELECOMMUNICATION TECHNOLOGIES TO DELIVER ASSISTIVE TECHNOLOGY SERVICES

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TELECOMMUNICATION TECHNOLOGIES TO DELIVER ASSISTIVE TECHNOLOGY SERVICES

This paper was developed by Kathleen Newroe, a free lance writer who has written extensively on the subject of distance education. Kathleen lives in Santa Fe, New Mexico.

MARCH 1991

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FOREWORD

RESNA, an interdisciplinary association for the advancement of rehabilitation and assistive technologies was awarded the technical assistance contract by the National Institute on Disability and Rehabilitation Research (NIDRR) under the *Technology-Related Assistance for Individuals with Disabilities Act of 1988 (P.L. 100-407).* The purpose of this contract is to provide technical assistance and information to states in the development and implementation of their consumer-responsive, statewide program of technology-related assistance.

This paper provides basic information about telecommunication technologies that can be used to deliver training, education, public awareness activities and other technology-related services to distant locations. This paper was developed as a result of a number of inquiries by states funded under the Tech Act.

The RESNA Technical Assistance Project thanks Kathleen Newroe, an independent writer and Barbara Keefe, Training Coordinator for the Maine CITE Project, for the development of this paper. The Project also thanks Barbara Keefe and Mark Schultz, Project Director of the Nebraska Assistive Technology Project for their review of the paper.

TELECOMMUNICATION TECHNOLOGIES FOR DELIVERING ASSISTIVE TECHNOLOGY SERVICES

INTRODUCTION

Over the past decade, telecommunication technologies have developed and been applied as powerful learning tools at all levels of education. For individuals with disabilities, the delivery of services enhanced by telecommunications can cover a broad spectrum of educational, medical and vocational objectives. The *Technology-Related Assistance for Individuals with Disabilities Act of 1988* (P.L. 100-407) encourages the development and implementation of a statewide, comprehensive, consumer responsive system of technology-related services.

For the working age population, the 1986 Amendments to the *Rehabilitation Act of 1973* very specifically mentions "the use of existing telecommunications systems (including telephone, television, satellite, radio, and other similar systems) which has the potential for substantially improving service delivery methods, and the development of appropriate programming to meet the particular needs of individuals with handicaps" (Title I, Section 103:b3 and Title II, Section 204:b6). For educational purposes, the Department of Education regulations concerning the 1990 Amendments to the *Education of the Handicapped Act* (retitled *Individuals with Disabilities Education Act*), specifies producing and distributing educational materials using such means as publications, telecommunications and conferences.

Telecommunication technologies are expanding opportunities and access to resources and training beyond those traditionally available. Telecommunication technologies are vehicles used to transmit information and instruction over distances. This paper is a review of current and viable telecommunication technologies available to deliver distance learning. The review is accompanied by examples of effective partnerships and networking that can be replicated or adapted by service providers and consumers. In some cases, the telecommunication technology will be seen to be the technology-related assistance itself. In other situations, telecommunications is the vehicle carrying the information and training needed to enhance the delivery of technology-related assistance to the individuals with disabilities, their families, and service providers.

Telecommunication technologies capable of delivering information and education over distances are particularly applicable for rural, isolated and remote areas. Telecommunication technologies, while not inexpensive, can nonetheless be seen as cost-effective. In carefully considered programs in which the goal is to enhance the quality of life of an individual with a disability, the benefits of distance education outweigh the costs. Distance learning technologies can be used to deliver courses for credit through a university system and training to individuals for whom mobility and travel is an obstacle. Likewise, the technologies can provide professional development seminars, workshops and degree programs to those in the field who can better manage the time for such development by staying close to home. Teleconferences can bring together individuals with disabilities, their families, and service providers in public and private agencies for a variety of purposes. Distance learning technologies can also assist in the collection of data and the dissemination of materials to sites and centers which cooperate in ventures with and for individuals with disabilities.

DEFINITION OF DISTANCE LEARNING

In general, any technology that electronically transports a teacher or instruction to a learner or learners at a distance could be considered a distance learning technology. Marshall McLuhan wrote, "The medium is the message." Today the media to which he referred is not only varied but capable of being combined with each other to meet various needs. A discussion of the technologies follows with the perspective that they can be brought together to accomplish educational, medical or vocational goals.

CABLE TELEVISION

Cable television was developed in the late 1940's to provide television reception to communities formerly unable to receive TV signals because of terrain or distance from area TV stations. An antenna located in an area having good reception, such as an elevated area picked up the broadcast signals and relayed them into town by way of coaxial cable lines. The big cable system antenna could pick up broadcasts from far away and also signals from satellites. The larger number of channels offered to the consumer came to mean a better television product that eventually became marketed even to communities where broadcast reception was not a problem.

Local Cable

One of the strengths of cable television is its capacity to carry many services beyond popular entertainment programming such as providing channels and sometimes equipment for public, educational, governmental or leased access to the community. Today, many communities still have "public access" TV. Some have leased access possibilities. Programming on these channels can be created by contacting the public access station to learn how much time costs on the leased channel and who is available to produce the programming. The National Federation of Local Cable Programers in Washington, D.C., has lists of community channels and possible networking ideas as well as advice on how to produce programs locally.

National Cable

Cable television can also be helpful in disseminating information about the potential of technology available to individuals with disabilities through some of its national networks and programming. Some of the new networks created in the past twenty years have addressed themselves to education, medical, and vocational areas of special interest to individuals with disabilities and those who work with them. The Learning Channel (TLC), for instance, will be airing "Ready, Willing, and Able," a three part series which profiles women with disabilities. The Health and Sciences Network (HSN) is a scrambled channel that is available

only to subscribing hospitals. Vanderbilt University also has a network that creates programming especially for health professionals.

The American Disability Channel (ADC) sent from San Antonio, Texas, currently is aired one hour every day prior to The Silent Network's (TSN) two hours of programming. This programming is offered free of charge to local cable operators. The Silent Network is a 10-year veteran in the field of national cable television featuring informational and entertainment programming and public service announcements for America's 28 million deaf and hearing-impaired individuals. The visual programs are provided with Open Captions, a see-through subtitle effect, sign language and full sound, all available simultaneously. The American Disability Council Channel (ADC) is a national cable television network featuring informational and entertainment programming and public service announcements representing every major disability and disability group in America.

Access to National Cable Channels: Two points need to be made about these national cable channels of information. First, some local political maneuvering might be necessary in order to receive the programming. If the local cable operator is not currently offering these channels and you wish to receive them, call the local operator, or visit the cable commission, or the mayor's office (the cable operator is licensed through the city government) and request the programming. ADC, being broadcast only a few hours a day often piggybacks onto a channel with the public access or local origination or educational service channel. Suggest this if it is not being done. If these tactics do not work, it might be possible to get a direct feed of the channels (see "Satellite Television" below).

Secondly, the national channels should be used as vehicles for disseminating information. ADC has a talk show, "Off-Hand" hosted by Herb Larson. ADC says it is a "telecommunications cooperative" providing persons with disabilities, organizations and corporations equal opportunity to television programming designed specifically by and for Americans with disabilities. Some current program producers include the American Red Cross, the Cystic Fibrosis Foundation, the Disabled Veterans of America, Helen Keller National Center, the National Easter Seal Foundation, the Texas Commission for the Blind and the Texas Commission for the Deaf, and the United Way. To develop programming on either TSN or ADC, a representative of the channel's National Disabilities Advisory Board should be contacted.

SATELLITE TELEVISION

Arthur C. Clarke, who played an important role in the development of satellite communications, and is recognized in the name the "Clarke belt," which he predicted would hold a satellite in position above the equator for purposes of relaying communications signals anywhere in the world. By 1986 there were 500 transponders or channels available on 27 satellites. Some of the transponders are dedicated to special commercial enterprises, relaying, for instance, entertainment programming to cable systems around the world. Satellite signals

are picked up by "dishes" (round antennas). The audience for the reception of satellite delivered programming can be large or small. The received signal can be sent out to a community of subscribers or, to a smaller audience--attendees of a satellite conference, for example. The signals are then available to anyone with a C-band or Ku-band dish and decoder.

With satellite delivery, the important point is reaching remote locations. In 1976, Alaska established the first satellite network for rural needs. The satellite carried telephone connections that had been too expensive to set up on land. When trying to reach many people in a largely dispersed population, satellite delivery may be the way to go. Time is also a factor. If the information needs to be delivered to all the people in all the locations at the same time, satellite delivery is a great help. The delivery system can be interactive as well as allow people to see and hear information and then discuss the programming immediately with a dispersed population (see "Interactive Television" below).

TELECONFERENCING

Many state universities have uplink/downlink facilities, which provides the capability to send a program to a satellite and have it delivered to many receiving (downlink) sites. Some networks, like the National University Teleconferencing Network (NUTN) are consortiums of university facilities. Such public institutions can help in getting a good price for transponder time as well as for production and marketing. The Society of Satellite Professionals International is a membership of people experienced in the fields of business, education, entertainment, media, science and industry who can be helpful with questions on regulatory policy, legal issues, and technical requirements as programs are created for individuals with disabilities and service providers. Teleconferencing, however, does not mean only delivery by satellite. Questions on audioconferencing and computers, as well as on video conferencing, can be addressed to the International Teleconferencing Association.

INTERACTIVE TELEVISION

Interactive means two-way communication. Information can be presented and feedback given at the same time. The delivery system might be television or radio or telephone or computer. Teleconferences and telecourses are good examples of interactive technology. The Supported Employment Telecourse Network (SETNET) located at Virginia Commonwealth University has been offering 1-way video and 2-way audio telecourses and teleseminars. Video is sent to enrollees at downlink (receiving) sites in ten to fifteen minute lecture or demonstration blocks. A toll-free number allows those watching to call in questions concerning the content of the live broadcast after each block of information. Paul Sale at SETNET says, "the big advantage of such a teaching format is allowing the students to see the real life stuff." In discussing situational assessments, for instance, the lecturer was able to talk about the parameters of the

practice and then integrate a pre-recorded site visit into the programming. Students at the remote sites then called in questions about what the lecturer said and what they had seen. Sale believes, however, that such telecasts constitute only about 50% of the training they are trying to convey. Pre- and post- telecast activities including discussion and role playing lead by on-site facilitators make up the other large part of the training.

FIBER OPTIC

Essentially fiber optic technology is a communication of light. Whereas coaxial cable could take the sound and sight (analog) waves of telephone, radio and television and transmit them over distance, fiber optic has a coder that transforms those analog waves into digital bursts of light. The analog wave bounces over the coaxial cable, sometimes even venturing outside the tubing. Fiber optic "cables" are actually fibers, each as minuscule as a human hair, and the transmission of light pulses from the coder's laser can be contained and directed so that the voice, data or picture remains sharp and focused in the direction of delivery. Fiber optic has more carrying ability (capacity) than coaxial cable. Such capacity allows for more "demand access" service. Just as satellite dishes allowed for the reception of more television channels, so fiber optic capacity allows for the transmission of more voice, data, and television. The transmission can be two-way. Fiber optic is often the "back bone" of new state networks. The Mid-State Educational Telecommunications Cooperative (MSET) is reputed to have the first fiber optic network in the U.S. dedicated to distance learning. High schools in the Little Falls, Minnesota, region are connected by over 78 miles of fiber optic cable paid for through a one mil tax levy and authorized funds from other state sources, including a low installation bid from the Upsala Coop Telephone Company.

MICROWAVE AND INSTRUCTIONAL TELEVISION FIXED SERVICE (ITFS)

ITFS began when a band of frequencies, similar to television frequencies but higher, were legislated to be set aside for educational "narrowcasting." Narrowcasting means distributing programming to a limited, well-defined audience. The signals are sent from "headend" origination or transmitter sites to receive-only microwave dishes. Since the ITFS signals can only travel a short distance, and must be in line-of-sight, the signal transmission is among fixed points, such as a group of hospitals in a region or schools within a district. This system also allows for interactivity, sometimes including two-way video so that the instructor can see the classrooms to which the signal is being sent. In California, the Long Beach Unified School District ITFS offers approximately 6,500 video lessons a year to seventy-five schools. A grant from the California Regional Occupational Program for Vocational Training was one of many funding sources for this program. Since microwave and ITFS systems require a license because of the limited amount of channel space available, using these systems to develop programming requires the cooperation of those holding the licenses, usually educational institutions.

COMPUTER-BASED APPLICATIONS

Whereas the other technologies we have discussed employ audio/video transmission the computer-based applications rely on communicating through the written word and data. Computers connected to modems that allow what is typed at one computer station to be sent over telephone lines to other stations can be a very effective means of education and training programs. CompuServe is a commercial, user-friendly online service that has responded to the disability community. Among the over 500 different services and forums available to the more than 250,000 CompuServe subscribers are the Handicapped Forum and the Human Disabilities Forum (HuD). Forums are part of SIGS (Special Interest Groups) which gather like-minded people together in an "electronic meeting place." Members can leave mail messages for each other in the electronic mail section. They can also call conferences for specific times and dates. This option allows a number of people to "converse" online about a specific subject. Specialized professional communications databases and bulletin board services (BBS) such as SpecialNet, operated by GTE also provide a national "meeting place."

MIXING MEDIA

Any of these media can stand alone or be mixed with each other depending upon the needs of the program and the audience. Tests, assignments, and administrative information that augment audio or video broadcasts or narrowcasts can be transmitted by computers through local area networks or electronic bulletin boards and databases. Pennsylvania Learning Network (PENNARAMA) is a statewide microwave and cable television interconnect. The microwave transmits to thirty-one cable television locations which then relay the university's programs into the homes of 700,000. The State Department of Education can be contacted for information about who the key players are behind distance learning technology networking. In some states, commissions on higher education or continuing education are the spearheads; in others, a governor's office or committee might be the lead. In some states, agricultural extension offices have been active in the use of distance learning technologies. Many rural states are better equipped than urban centers although some cities have corporate microwave networks and teleconferencing facilities.

PLANNING PROCESS FOR USING DISTANCE LEARNING TECHNOLOGIES

The place to start planning a distance learning project is with the goal of the overall project. If the goal is based on reaching a widely distributed, but limited and well-defined audience, then distance learning technologies should be considered. The basic six questions of communications - who, what, why, how, where and when - are good guidelines for organization once it has been decided that distance learning technology will best address your needs.

Who:	Who is your audience?
What:	What is the goal of your project?
Why:	What is the purpose of the project?
How:	To what telecommunication technology does your goal lend itself?
Where:	Think about how and where the learner will have easiest access to learning.
When:	Is it feasible to assume the audience you are seeking will be able to participate at the time you schedule?

These few questions for planning may seem overwhelming, but they are the tip of the iceberg. Other considerations during the planning process include making sure the media used is accessible to persons who are visually impaired or blind and to persons who are deaf or hearing impaired. A description video service or closed captioning can be used. Think also about alternatives in the event of telecommunication technical difficulties, how to cope with user anxiety and resistance to new technologies, and problems that may arise in getting everyone to cooperate in all the areas of production. Nonetheless, a well-thought out plan for the nature and content of the project should support the process. Because it is a process, a management pattern technique like GANTT scheduling, the Critical Path Method (CPM) or PERT charting can be essential to a successful program since there are so many variables and, inevitably, so little time.

A SAMPLE PLANNING CONFIGURATION

The Australian Society of Accountants used a wheel configuration in processing the development of a distance course they wanted to institute. They began with "justification" - asking if the distance education program is justified, why and by whom. Moving clockwise the next problem to be surmounted was "development" - what initial action commitments needed to be made, backed by what information or assumptions, what problems were arising in the planning, how would the program be designed, how would the development be organized. Next, "transformation" including an understanding of how distance students learn, what kind of learning materials and interaction strategies would be needed, what specialists would be integrated into the program, how teachers could gain insight into the curriculum. "Implementation" included what support would be required to commence, what provisions there would be for early adjustments, and how to incorporate change as the program progressed into practice. Finally, "stabilization" asking when the course could stand on its own, how the program was being integrated into the institution's vision, what ongoing evaluation strategies would be used and what predictions could be made for the long-term future of the program. At the center of this wheel, interacting with each phase of the program development was criticism monitoring, evaluation and feedback to all those involved.

COST OF TELECOMMUNICATION TECHNOLOGY

The cost associated with telecommunication technologies to provide distance learning varies depending on a number of factors:

- design of the system
- range and scope of the system
- capacity level
- lease versus buy options
- cost of equipment

Additionally, costs will also vary based on the start-up of a system which involves transmitting and receiving equipment versus maintenance costs which involves programming and operation. Costs will differ for those who only receive programming versus those who originate and transmit it and whether or not you use existing telecommunication resources.

Cable service is relatively inexpensive, especially for school districts. All that is required usually is for the cable company to run a feeder cable and allocate a channel. The costs go up if you connect several locations because transmission technology is required. To receive cable programming, a subscription to the service is needed. The cost can range from a few hundred dollars upwards.

Instructional Television Fixed Service (ITFS) is also a relatively low cost way of delivering one way video to multiple remote sites. However, ITFS is not good in hilly areas. The costs associated with ITFS involves installation and putting up relay towers. The costs for these services can range from $10,000 to $100,000. An engineering study is usually required to see what towers already exist.

There are a number of costs associated with satellite service: uplink facility (studio and cost of electronic equipment), transmission time, downlink (satellite dish, converter, VCR, TV, internal wiring). Other factors affecting cost include voice, data and video capabilities; receive only versus send and receive; and subscription costs for delivery from multistate providers. Uplink costs range from $300,000 to $500,000; production equipment from $10,000 to $1 million (equipment can be rented); and downlink costs range from $2,000 up to $5,000. Costs for transmission time is based on whether you lease or buy. The cheapest way is to contract with a carrier or resale carrier for a specified amount of time--hourly, yearly, or multi-year.

Presently, the most expensive telecommunication technology is fiber optic. Costs involve a per mile charge for installation. However, most organizations do not install their own, they sublease from a phone carrier. In addition, transmission technology and equipment used in the production or modulating should be considered. Fiber optic technology can range anywhere from several thousand dollars to millions of dollars.

SOURCES OF COOPERATION

A little help from friends is a big factor in producing a successful, far-reaching program. Cooperative ventures can not only lend expertise, but also, sometimes, help with funding. NYSERNET (New York State Education and Research Network) was begun in 1987 to link fourteen State Universities and Brookhaven National Laboratory with Cornell's computer center. In the next two years, corporate research centers came on board. Funds for the start-up of the program were provided by New York Telephone, Rochester Telephone Corporation, IBM and Eastman Kodak.

One exemplary project held a teleconference to help in the development of three videotapes. Dr. Lois Schwab, then Associate Dean of the College of Home Economics at the University of Nebraska at Lincoln, worked on developing these 28-minute videotapes focused on assistive technology for individuals with communications disabilities, upper and lower extremity disabilities. The project coordinators visited rehabilitation centers to update the information they had on what technologies were being used and what were desired. A market search was also done. All assistive technologies were reviewed, from the simple, such as specially designed clothing to the more complex, like synthesized speech devices. A national committee of individuals with disabilities, occupational therapists, state agency workers and technology experts was set up. Dr. Schwab and her advisors sent out scriptboards, details on what would be included in each tape and how it would be shown, to these committee members asking for feedback through telephone conferencing and individual written statements. Video drafts of the three tapes were produced and a three-hour interactive satellite workshop was scheduled. Ten sites were chosen to be locations responding with in-depth critiques. Coordinators at these sites were paid to insure that all written forms were gathered from the critiquing viewer participants. Word was sent out to other interested parties, as well and as a result, 146 downsites including Independent Living Centers, Rehabilitation Centers, campuses, lay people and advocates also participated. A national WATS line was overloaded with questions and comments about the three videotapes. The tapes were reedited where needed in response to the critique, produced and given to the Great Plains National Instructional Television Library for marketing. The Library has the tapes available in 1/2" or 3/4" format. The 1/2" is suitable for home VCR presentation. The 3/4" format fits the needs of broadcast (or cable) television. The tapes may be purchased or rented.

Dr. Schwab's 1985 project illustrates two important areas in the use of telecommunication technologies for distance education. First, the project was well planned from start to finish with primary consideration given to the needs of the intended audience. Second, the project was a cooperative venture in a number of ways. It used a combination of telecommunication technologies. It drew upon many divisions within the university and without. Dr. Schwab's project saw diffusion on at least two levels. By letting people know about the teleconference and helping them understand how to receive the programming, she got feedback from interested parties at 146 sites at the same time she was disseminating information. By marketing the finished product, the project has a life beyond the production phase.

OTHER DISTANCE LEARNING PROJECTS

The Annenberg/CPB Project

This project funds programs that promote research and development in various telecommunication technologies. Currently two telecourses are available that were developed from techniques learned from working with persons with disabilities. Educational Networking For Interaction (ENFI) is a computer-based program to encourage and improve skills in using the written word. The technique of having students at various stations within a local area network (LAN) communicate with each other only through computer delivered messages was borrowed from a system used by an individual with hearing-impairments. Through practice and review, students improve their writing abilities. Another set of telecourse projects called "New Pathways to a Degree" using a combination of video, computer and fax systems was first developed for individuals with mobility-impairments in mind. Many of Annenberg/CPB's programs provide information about specific technologies. "The New Literacy," a video-tape about computers and their use, is closed-captioned. "Bridges to Learning" is an introduction to distance learning technologies. You can receive a catalog of Annenberg/CPB's video and audio tapes (and their supplemental written materials) by calling them.

Star Schools Program

Public Law 100-297 created the Star Schools Program. With the goal of expanding and enhancing educational opportunities in rural, disadvantaged, and isolated areas, the U.S. Department of Education is currently in the second round of the program. Under the Star Schools Program, grantees develop high-technology teaching networks to provide students and teachers with advanced courses in mathematics, science, and foreign languages. Technologies used include live, interactive instruction via satellite, hands-on microcomputer programs and videodisc software. Some of the previous two-year grants offered graduate credit courses and staff development programs. One of these, the Satellite Educational Resource Consortium (SERC), combines the management resources of the chief state school officer and the chief public television administrator in the 20 states that form the partnership. Information on SERC is available from the Southern Education Communication Association of Columbia in South Carolina. These are partnership programs with the grantee contributing at least 25 percent in additional funds to the project. Nearly 2500 new downlink sites have been established because of the Star Schools Program.

CONCLUSION

Distance learning will continue to be one of the major growth areas of the next few years. Is distance learning technology too expensive? The only answer is, "it depends." It depends upon how much of the technology is already in place, what systems can be borrowed or utilized, what has to be done from scratch. According to *Time Magazine* (May 22, 1989) a

school district may pay as much as $8,000 for a satellite dish, cordless phones and electronic keypads or computer terminals needed for students to communicate with long-distance teachers. But what if the dish is being rented or loaned, the telephones donated by the parent's association, the computer terminals already in a computer lab? The way to assess cost is during the planning process. Of the technologies discussed in this paper, the least expensive are probably the ITFS and the computer-based applications. Fiber optic and microwave applications are perhaps the most expensive. However, the technology and its benefits need to be weighed against many factors. For some, including some individuals with disabilities, the electronic delivery of information makes it the most accessible delivery. A boost to cost-effectiveness is found in using distance learning technologies in partnerships and networking to address multiple needs. A holistic view, a sense of the "big picture," is necessary.

New and updated federal acts and regulations for individuals with disabilities, their families and service providers encourage public awareness, education and training programs. Setting up distance learning partnerships with private and public resources like vendors and educational institutions or professional associations can be an exceptional way to respond to legislation such as the *Technology-Related Assistance for Individuals with Disabilities Act of 1988*, the *Rehabilitation Act and its Amendments*, and the *Individuals with Disabilities Education Act* (also referred to as the *Education of the Handicapped Act*).

Each state has unique needs and resources. A thorough understanding of the history of distance learning in the state, a comprehensive survey of available facilities and partnerships, an integrated and cooperative over-all plan, and a solid decision-making process for a realistic determination of the goals and objectives to be obtained by any one element of the over-all plan are essential to a successful distance learning project.

Following is a case study of one state funded under the *Technology-Related Assistance for Individuals with Disabilities Act of 1988 (P.L. 100-407)* which is using telecommunications technology. The Maine CITE Project uses interactive television to provide training and public awareness to persons with disabilities and service providers on assistive technology.

CASE STUDY: MAINE CONSUMER INFORMATION AND TECHNOLOGY TRAINING EXCHANGE (MAINE CITE)

DELIVERING ASSISTIVE TECHNOLOGY PROGRAMMING THROUGH DISTANCE EDUCATION

OVERVIEW

The Maine Consumer Information and Technology Training Exchange (Maine CITE) is a project supported by the Maine Department of Education, Division of Special Education, with a grant from the National Institute on Disability and Rehabilitation Research, U.S. Department of Education. Maine CITE provides assistive technology training to people with disabilities, their families, professionals and employers statewide.

The project is also increasing access to technology through a centralized information resource, and a research study of policy and funding barriers. The training related to assistive technology uses several methods. This paper focuses on the effective use of programming delivered by using interactive television.

Maine is the largest of the New England states with the lowest density of population east of the Mississippi River. Nearly 1.2 million people live in Maine, 70 percent of whom live in rural communities of less than 10,000 people. The Department of Education reports 27,074 children with disabilities among Maine's school-age population, ages 5-20. The Bureau of Rehabilitation estimates 63,655 adults, age 22 years and above, (approximately 10% of the adult population), have a disability limiting a major life activity.

To implement a training program that would allow for geographic diversity without requiring people to travel great distances Maine CITE made a decision to use the University of Maine System's interactive television extensively.

MAINE'S INTERACTIVE TELEVISION SYSTEM

The Maine CITE project works cooperatively with the University of Maine at Augusta's staff to help produce its programs over the interactive television system.

Maine's interactive television (ITV) is the most comprehensive terrestrial system in the country. A two-way audio and visual fiberoptic spine, leased from New England Telephone, connects electronic classrooms located at each of the University of Maine System campuses. From each campus, the classroom signal is broadcast via point-to-point microwave to an ITFS microwave transmitter and onto multiple receive antennae at the various receive sites.

Distances as great as 400 miles might separate presenters, facilitators, and participants. Because the signal can be transmitted from each campus throughout its own geographical region or throughout the entire state, the ITV system proves efficient and cost effective.

People at remote ITV classrooms are connected to presenters who are simultaneously presenting to a "live" classroom of people on campus. In this electronic classroom one camera focuses on the presenters, while another scans other visual material. The presenters and visual images are electronically "transmitted" to the remote sites where the participants can see and hear the presenters on television monitors. An audio talk-back system permits people in these distant locations to interact with the presenters and with other participants.

ITV technology links these people, generating an interaction allowing persons with low incidence disabilities to probe participants across the state immediately for ideas and answers that might not have been available in their area, increasing the amount of receivable information.

PREREQUISITE TO SYSTEM USE

Seventy-seven sites are capable of receiving programs statewide over the University's comprehensive ITV system. Maine CITE uses only nine of the ITV sites. The nine sites are video and audio interactive, meaning all participants can see and hear one another. In general, the criteria for selecting the sites has been "complete access" according to the ANSI standard for buildings. Clearly the Project needed to explore policies regarding access issues in the system. In response to concern by project staff, Department of Education and University administrators to assure access to all sites, the project uses only locations meeting those standards. We are currently developing a comprehensive plan to assist other sites in meeting access requirements.

Educational access was another driving principle for training. All Maine CITE programs are captioned for people who are hearing impaired and are available in audio and videotape free of charge. Interpreters are secured for anyone requesting one at their site. Print materials that are needed for the actual program are mailed to the various facilitators statewide one week prior to the program broadcast. Information is available in large print, braille, or audiotape.

PROGRAMMING

All Maine CITE broadcasts adhere to the following guidelines. We consider users of assistive technology the "experts"; their expertise is called upon for each program. Programs are developed and presented in collaboration with one or more organizations. Collaborators plan agendas, design program formats, identify and target audiences, and supply some of the material distributed in information packets at the program. Collaborators participate in the

presentation of information as well. Facilitators are used at all ITV receive sites. People with disabilities or parents of children with disabilities again are the preferred facilitators.

Original videotapes are developed for most live ITV programs, and are either aired later on cable stations or shown internally in organizations. These videos help us reach thousands of people with specific disability issues as well as the general public.

Finally, all programs are evaluated for content. A special series of questions are included in the evaluation pertaining exclusively to the use of the ITV system.

SUMMARY

Maine CITE and its partners are excited about the emerging potential of ITV and other technologies to reach individuals who might otherwise have no access to information and services. Overwhelmingly, participants found the ITV model to be an effective delivery mechanism for accessing new information.

Approximately 1400 people participated in the ten programs presented by Maine CITE in its first year. The following matrix represents the kinds of programs developed for various audiences.

PROGRAM	TOPIC	VIDEOS PRODUCED	AUDIENCE	COLLABORATORS
2/14/90 KID TO KID	Demonstration of children using augmentative communication devices	• An interview with Larry Harvey • Don Swander at Riverton School	Children, parents, teachers: occupational therapists, speech/language pathologists	Maine Parent Federation & SPIN
2/27/90 KID TO KID	Demonstration of children using assistive devices	---	SAME AS ABOVE	SAME AS ABOVE
3/30/90 OPENING THE DOOR	A forum on barrier-free environment	An access tour of Augusta City Hall with Ron Hanson	Architects, code enforcement officers, University faculty managers and consumers with disabilities	Alpha One, Center for Independent Living
4/27/90 ENGINEERING FOR DISABILITIES	Demonstration of adaptations	---	Consumers who are disabled, occupational and physical therapists, engineers and inventors, vocational rehabilitation and independent living counselors	Department of Human Services, Bureau of Rehabilitation
6/29/90 IN THE DRIVER'S SEAT	Driver assessment and education program for people with disabilities	Alpha One Driver Assessment and Education Program	Consumers with disabilities, vocational rehabilitation, and independent living counselors, driver education teachers, occupational and physical therapists	Alpha One, Center Independent Living

PROGRAM	TOPIC	VIDEOS PRODUCED	AUDIENCE	COLLABORATORS
9/15/90 TECHNOLOGY SOLUTIONS	Statewide discussion among people who use assistive technology, telling of adaptations they find useful	From the kitchen of Leigh Phillips	Consumers with disabilities, Vocational rehabilitation and Independent Living counselors, parents	• Maine Independent Living Services, • Department of Human Services, Bureau of Rehabilitation
10/27/90 TOY AND RECREATION FAIR	Demonstration of various adapted toys and recreational devices	• Ricky and his dad play Nintendo, • Muppet keyboard, • Carl's Great Bike	Parents, children with disabilities, special education teachers, occupational and physical therapists	Maine Parent Federation/SPIN
12/14/90 ASSISTIVE TECHNOLOGY FOR PEOPLE WHO ARE DEAF AND HARD OF HEARING	Demonstration of old and new assistive technology and services	Assistive Communications Lab at Gov. Baxter School	Consumers with hearing impairment, teachers, vocational vocational rehabilitation counselors, parents	• Gov. Baxter School for the Deaf, • Bureau of Rehabilitation, Office of Deafness
1/11/91 COMPUTER ASSISTIVE TECHNOLOGY FOR THE BLIND & VISUALLY IMPAIRED	A panel of consumers discussing different output modes	• Tour of the Computer Assistive Technology Center at Maine Center for the Blind and Visually Impaired • Peter Slowkowski @ UNUM • Returning to school: Vernon Peacock	Consumers who are blind and visually impaired, employers, vocational rehabilitation and Independent Living counselors	• Bureau of Rehabilitation, Div. of Blind and Visually Impaired • Maine Center for the Blind and Visually Impaired of ME • National Federation of the Blind of Maine • American Council of the Blind of Maine
2/15/91 PLANNING FOR ASSISTIVE TECHNOLOGY CONFERENCE CONSUMER FORUM	Program planning for 1991 technology conference	---	Consumers with disabilities	• Gov Baxter Sch for the Deaf • ME Indep. Living Services • Alpha One • ME Assoc. of Directors of Services for Exceptl Children • ME Parent Federation/SPIN • Div on Blindness Visual Impairment

GLOSSARY

Analog — the historical mode of transmitting telephone or voice signals, information represented in the form of continuously variable elements.

Broadcast — over-the-air transmissions conveying programs intended to be received by the general public.

Cable television — a system that delivers multiple channels of video programming to subscribers through a coaxial cable. Cable providers are locally franchised, but are also regulated on the Federal level and may be regulated on the State or local level as well.

C-band — a band of frequency available for satellite transmission. C-Band have as many as 24 different channels (or transponders) and are considered "low-power" satellites. Commonly used by broadcasters and cable TV scheduled services.

Coaxial cable — a cable composed of an inner wire conductor surrounded by a hollow cylindrical conductor with layers of insulation between.

Common carrier — a supplier that provides telecommunications services to the public, subject to state and Federal Communications Commission regulation.

Decoder — a device to translate coded data for reception.

Downlink — a unidirectional transmission path from a communications satellite to a receive site; the receive site itself, an antenna, often dish or saucer shaped (opposite of an uplink).

Fiber optics — the technology for transmitting light in thin glass fibers. It can be used to carry relatively large amounts of information over long distances.

Frequency — a measure of the number of electromagnetic waves that pass a given point in a given time period; equal to the speed of light divided by wavelength and expressed in cycles per second or hertz. A short wavelength is equivalent to a high frequency.

Hertz — a measurement of frequency equal to one cycle per second.

Interactive system	a system capable of transmitting signals in both directions, allowing viewer response or participation.
Ku-band	a band of frequency available for satellite transmission, operated at higher power, fewer transponders but offer possibility of smaller dish--most newer technology is compatible with both C and Ku.
Laser	a tightly packed, narrow beam of light formed by the emission of high energy molecules.
Microwave	short electromagnetic waves in the radio-frequency spectrum at 1000 megahertz or greater; signals that can be transmitted at these frequencies between two line-of-sight locations.
Modem	a modulation-demodulation between computers allowing data transfer on a telephone line.
Narrowcasting	programming targeted to appeal to specific demographic or special interest audiences, as opposed to mass audiences.
Public television	noncommercial television programming broadcast by stations which are supported by government funding, corporate and private donations, and other revenue sources.
Satellite (Communications satellite)	a relay station circling the earth that receives video, audio, data and other transmissions from uplinks and retransmits them to downlinks. Weather, geodetic, navigation, reconnaissance, sensing, scientific and manned satellites are in orbit as well as communications satellites.
Scrambling	with the decoder's unique unit address for your location the incoming signal is unscrambled as long as you have subscribed to the service.
Signal	electromagnetic energy used to convey information.
Telecommunications	the transmission of signals of any kind by wire, radio, optical or other electromagnetic systems.
Uplink	a unidirectional transmission path from an origination point to a communications satellite (opposite of a downlink).

WATS (wide area telephone service) — a telephone service allowing a subscriber to make calls to specific geographic areas for a rate based on volume and time-of-day but generally less than that charged for toll service. Customers may also purchase "800" service which permits the subscriber to receive calls placed from specific areas with no charge to the caller.

Transponder — the receiver onboard the satellite collects the signals being transmitted from various locations on earth and then relays them back into your dish which collects them for processing by your satellite system.

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